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**Biology: Hominid Skull Comparison Lab**

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**Introduction:**

If you saw two people who looked very similar, you might guess that they were related. Relatives share a common gene pool. For this reason, they are likely to have similarities. If two different kinds of organisms are very similar, you might also suggest that they are related or perhaps they have a common ancestor. Organisms with common ancestors once shared a common gene pool; therefore, they have similarities. The large number of similarities between humans and apes in outward appearance, internal structure, and biochemistry has led scientists to search for common ancestors. Primates is a class of organisms that includes Lemurs, Tarsiers, Monkeys, African Apes, and Humans. African Apes (i.e. gorillas, chimpanzees, and bonobo) and Humans differ from other Primates because we lack a tail, along with other characteristics. The term Hominin is used to recognize the close evolutionary relationship between Humans (*Homo sapiens*) and African Apes. Scientists have studied many fossils and have found fossils that have characteristics between those of humans and apes. The degree to which a fossil has human characteristics can be measured. The shape of various parts of the skeleton can be described in terms of indexes (an index is a comparison of two measures of quantities).

**Pre-Lab Questions:**

1. How do modern day gorillas differ from modern day humans?
  
2. What is some prehistoric evidence that early humans were bipedal (meaning that their hands were free)?
  
3. How do fossils provide us with a "window" into the past?

**Purpose:** To discover some similarities and differences between fossil skulls of the Hominid family in order to develop a pattern of the gradual accumulation of traits over time, leading to modern day humans.

**Materials:**

- Fossil Skulls (these are "models" but they are to be treated with care and respect and no marks should be made on the skulls)
  - *Homo Sapien, Homo erectus, Gorilla gorilla, Pan troglodytes (chimpanzee), Australopithecus afarensis, Homo neanderthalensis, Australopithecus boisei*
- Calipers
- Ruler
- Protractor

**Procedure:**

- Your teacher will assign you a skull that your group will be responsible for determining characteristics.
- Every member of your group should have the chance to measure at least 2 parts of your assigned skull.
- Always measure in millimeters (mm), and round to the nearest mm.
- Use calipers to measure straight distances through curved surfaces, measuring the caliper point gap with the ruler.

## Traits to observe:

### Braincase (items 1-6 on data table):

1. **Max Width** of braincase: straight distance from left side of braincase to right side, at widest point in the region that would be curved around the brain (**use calipers**).
2. **Max Length** of braincase: straight distance from forehead to rearmost curved surface of braincase (do not include brow ridges). **Use Calipers**
3. **Post-Orbital Construction**: straight distance from the left side to right side of the indented temple region just behind the sides of the brow ridges. **Use Calipers**
4. **Sagittal Crest**: Look for a raised bony ridge along the midline of the very top of the braincase, running from behind the forehead to rear of skull (answer YES or NO on data table). A sagittal crest indicates that there were large neck muscles in order to support the head and power shoulder movement.
5. **Forehead Shape**: Does it rise straight up (vertically) from the brow ridges (like yours does), or is it sloped (angled directly toward the back of the skull)?
6. **Foramen Magnum** location: The large hole on the underside of the skull, through which the spinal cord would pass. Is it toward the rear, is it more in the middle of the skull?

### Face (items 7-10 on data table):

7. **Browridge**: Is there a defined browridge protruding over the eye sockets (orbits)? Write YES or NO on your data table. Modern humans have lost the characteristics of having prominent browridges.
8. **Browridge size**: Is this large or small? It may help to look at other skulls.
9. **Jaw Angle**: How far do the jaws protrude from the facial plane? Using a piece of paper lay it flat on the facial part of the skull; this should create an angle that will be easy to measure with a protractor. A jaw angle of approximately 90 degrees is a trait of modern humans.
10. **Chin Shape**: Does the chin protrude forward slightly in front of the teeth (like ours), or is it curved down and back?

### Teeth (items 11-15 on data table)

11. **Dental Arcade**: Are the rows of teeth curved, or arranged in a rectangular shape, with the molars and pre-molars in straight, approximately parallel sides, and incisors straight across?
12. **Dental Formula**: From the midline of one jaw (upper or lower), **count** the number of teeth of each type on **one-side**: incisors, canines, premolars, molars. For example 2-1-2-3.
13. **Angle of incisors**: Are they approximately vertical (like ours), or are they slanted forward?
14. **Canine Diastema**: Is there a large gap in the lower tooth row between the incisors and the lower canines, a gap where the upper canine can fit? Write YES or NO in data table.
15. **Canine Length**: How long is the upper canine (from bone socket to its tip)

### Summary:

- Once all data has been collected from all skulls in the summary section indicate if the characteristics of the species (Cro-Mag, Neanderthal, A. boisei, and A. Africanus) are more ape-like (A), human like (H), or unique (U)
- This can be done by comparing your data to the data collected for modern day humans, and great apes (gorilla and chimpanzee)

### Skull Analysis Questions:

1. Describe two features of a hominid's skull that suggest it was bipedal.
  - a.
  - b.
2. List the hominid skulls in order of most distant from modern day humans to most recent, start with the skulls that had the most ape-like features.
3. When the skulls are arranged from most distant to most recent they generally show small differences from skull to skull, trending toward the most modern condition. What does this suggest about their biological relationship?
4. Compare the brain case sizes between older hominids and modern day humans, what do you notice? How might have the adaptation of a larger brain case benefited humans?
5. Compare the teeth between skulls, what might this suggest about a change in diet?
6. Why is it misleading to say that humans evolved from apes (such as gorillas)?